

EPICENTER
research summit

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Teaching Creativity

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Background

- Acting Assistant Professor in Mechanical Engineering at Stanford
- Research specializes in quantitative representations of the consumer and other stakeholders in the design process
- Crosses into marketing, psychology, and economics
- Taught “Creativity and Imagination in Engineering Design” at Iowa State University for the past five years
- Worked at 30-person product design company prior to Ph.D. at Michigan
- One “failed” small-business, one “failed” invention start-up

CIRAS and Innovation Engineering: How do we know it works?



Images from:
www.innovationengineering.org

Literature review of test vs. control experiments

Table 1 Literature related to the IE Create category

Tool/Advice	Summary	Supporting Literature	Refuting or Mixed Literature
Mind Maps	Tool for graphical organization and sharing of information	(Kokotovich 2008)c, (Unalan 2007)c,	
TRIZ	Tool for systematic creativity	(León-Rovira, Heredia-Escorza & Río 2008)c, (Ogot & Okudan 2006)c, (González-Cruz et al. 2008)c, (Birdi, Leach & Magadley 2012)w	
Stimuli	Input from an outside source	(Fink et al. 2010)l, (Valacich, Jung & Looney 2006)l, (Daly et al. 2012)c, (Howard, Culley & Dekoninck 2011), (Ocker 2005), (Roy 1993), (Cooper, Edgett & Kleinschmidt 2002), (Leonard & Rayport 1997)	(Linsey et al. 2010)l
Associations	The process of forming mental connections between thoughts	(Freedman 1965)c, (Coskun 2009)l, (Miller, BJ et al. 1970)c, (Cheng et al. 2010)c	
Groups	Working collaboratively with others	(Ocker 2005), (Paulus & Yang 2000)l, (McGlynn et al. 2004)l, (Coskun 2011)l, (Pirola-Merlo & Mann 2004)w	(Taggar 2002)c, (Diehl & Stroebe 1987)c1, (Larey & Paulus 1999)l, (Thornburg 1991)l, (Mullen, Johnson & Salas 1991)
Dual Brain	Left hemisphere controls analytical thinking while right controls creativity	(Harkins & Macrosson 1990)l, (Mihov, Denzler & Förster 2010)	(Kowatari et al. 2009)l, (Fink et al. 2009)l, (Abraham et al. 2012)l, (Howard-Jones et al. 2005)l
Humor	The ability to appreciate incongruities and comical situations	(Ocker 2005), (Humke & Schaefer 1996)l, (Rouff 1975)c, (Treadwell 1970), (Ziv 1976)l	

See: Du, P., Miller, C., MacDonald, E., and Gormley, P., "[Review of Supporting and Refuting Evidence for Innovation Engineering Practices](#)," Under Review, International Journal of Product Development.

NIST/MEP – the perils of not “knowing”

“NIST MEP has invested a very substantial amount of money (apparently at least \$30 million) in developing tools [of which IE is a component]...There is no track record of success, and early indications from the field suggest that gaining traction with them will be a long and difficult journey”

From: 21st Century Manufacturing: The Role of the Manufacturing Extension Partnership Program (Wessner, 2013)

So...do I know what I teach works?

....sort-of.

Design-of-experiment issues:

- Self-selecting bias
- Placebo effect
- Never apples-to-apples for comparison

But

- Most approaches directly or adapted from research
- Small class allows me to directly observe outcomes

Creativity and Entrepreneurship

Important concepts-in-common that must be taught:

- Trusting yourself
- Learning from “failure”
- Tolerance of risk

Learning from Failure

Multi-round Toy Pitch Assignment

Ability to switch team project idea at any point

Tolerance of Risk

Hearing from other entrepreneurs

Skype lectures have proven most effective

Details on dollars invested, sleepless nights, payoffs

Making the students get up on stage

Trusting Yourself

Learning about personalities, your specific personality

Learning the key characteristics for creativity (as documented in research)

Self-evaluation of assignments

Portfolio of “Creative Essence”

Creativity vs. Entrepreneurship

Important concepts-in-conflict that must be taught:

- Seeking collaboration vs. dealing with loneliness
- There is no right answer vs. you need to pick something
- Limitless exploration vs. budgets and deadlines
- Removal of structure vs. giving structure
- Seeking risk vs. managing risk
- Moving outside of your comfort zone vs. making others comfortable

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Thank you!



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